

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

1. Work request WCC fills out this section.
☐ Standing Work Permit

Requester: Don Lynch	Date: 6/26/2014	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 7/7/2014	Est. End Date: 10/31/2014
Brief Description of Work: Removal of VTX & FVTX subsystems from PHENIX IR to Physics for maintenance, repair and upgrade, reassembly and re-installation in IR			
Building: 1008, 510	Room: IR	Equipment: VTX & FVTX	Service Provider: PHENIX Techs, VTX & FVTX experts

2. WCC, Requester/Designee, Service Provider, and ESSH (as necessary) fill out this section or attach analysis

ESSH ANALYSIS							
Radiation Concerns	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> NORM	<input type="checkbox"/> Other
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group				<input type="checkbox"/> Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
Radiation Generating Devices:	<input type="checkbox"/> Radiography		<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges		<input type="checkbox"/> X-ray Equipment	
Safety and Security Concerns	<input type="checkbox"/> None		<input type="checkbox"/> Explosives	<input type="checkbox"/> Transport of Haz/Rad Material		<input type="checkbox"/> Pressurized Systems	
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Critical Lift	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Magnetic Fields*	<input type="checkbox"/> Railroad Work			
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Nanomaterials/particles*	<input type="checkbox"/> Rigging			
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Noise*	<input type="checkbox"/> Silica*			
<input type="checkbox"/> Biohazard*	<input type="checkbox"/> Elevated Work	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Non-ionizing Radiation*	<input type="checkbox"/> Security Concerns			
<input type="checkbox"/> Chemicals/Corrosives*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lead*	<input type="checkbox"/> Oxygen Deficiency*	<input type="checkbox"/> Suspect/Counterfeit Items			
<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Ergonomics*	<input type="checkbox"/> Material Handling	<input type="checkbox"/> Penetrating Fire Walls	<input type="checkbox"/> Vacuum			
Ladder Access Required: <input type="checkbox"/> Portable Ladder <input type="checkbox"/> Fixed Ladder- Status/Restrictions:							
* Safety Health Rep. Review Required <input type="checkbox"/> Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM <input type="checkbox"/> Other							
Environmental Concerns				<input checked="" type="checkbox"/> None			
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad/GHG)				<input type="checkbox"/> Land Use Institutional Controls			
<input type="checkbox"/> Chemical or Rad Material Storage or Use				<input type="checkbox"/> Liquid Discharges			
<input type="checkbox"/> Cesspools (UIC)				<input type="checkbox"/> PCB Management			
<input type="checkbox"/> High water/power consumption				<input type="checkbox"/> Spill potential			
<input type="checkbox"/> Waste disposal by:				<input type="checkbox"/> Other			
Pollution Prevention (P2)/Waste Minimization Opportunity: <input type="checkbox"/> No <input type="checkbox"/> Yes				Environmental Preferable Products Available: <input type="checkbox"/> No <input type="checkbox"/> Yes			
FACILITY CONCERNS				<input checked="" type="checkbox"/> None			
<input type="checkbox"/> Access/Egress Limitations				<input type="checkbox"/> Intermittent Energy Release			
<input type="checkbox"/> Credited Controls (Use USI Process)				<input type="checkbox"/> Electrical Noise			
<input type="checkbox"/> Configuration Management				<input type="checkbox"/> Potential to Cause a False Alarm			
<input type="checkbox"/> Impacts Facility Use Agreement				<input type="checkbox"/> Temperature Change			
<input type="checkbox"/> Maintenance Work on Ventilation Systems				<input type="checkbox"/> Utility Interruptions			
<input type="checkbox"/> Vibrations				<input type="checkbox"/> Other			
WORK CONTROLS							
Work Practices							
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment	<input type="checkbox"/> Security (see Instruction Sheet)			
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation	<input type="checkbox"/> Other			
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")	<input type="checkbox"/> Electrical Inspection Required			
Personal Protective Equipment							
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input checked="" type="checkbox"/> Gloves, as necessary	<input type="checkbox"/> Lab Coat	<input checked="" type="checkbox"/> Safety Glasses, where req'd			
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator*	<input type="checkbox"/> Safety Harness			
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers	<input checked="" type="checkbox"/> Safety Shoes, as req'd	<input type="checkbox"/> High visibility cloths/vest	<input type="checkbox"/> Other	
Permits Required (Permits must be valid when job is scheduled.)							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems					
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No					
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other					
Dosimetry/Monitoring							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD				
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization				
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O ₂ /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other				
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump					
Training Requirements (List specific training requirements)							
CA -Collider User, PHENIX Awareness,							
Work screening has identified the following as the reason for permitted work:				When work is categorized as worker planned work and a permit is used only the following signatures are required: (Although allowed, there is no need to use back of form)			
<input type="checkbox"/> ESSH				WCC: _____ Date: _____			
<input checked="" type="checkbox"/> Complexity				Service Provider: _____ Date: _____			
<input checked="" type="checkbox"/> Work Coordination				Authorization to start: _____ Date: _____			
<input type="checkbox"/> Permit Not Required (Sections 3 through 7 optional)				(Department/Division, or their equivalent, Sup/WCC/Designee)			

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail): During the 2014 Shutdown, PHENIX will be (1) un-installing the VTX & FVTX detector subsystems, (2) transporting the VTX & FVTX detector 1/2's to a BNL Physics lab for disassembly & separation of the VTX and FVTX, (3) maintenance, repair and upgrade of the VTX and FVTX sections, 4) the FVTX sections will then be re-assembled, reintegrated and re-surveyed with the VTX.(5) the re-assembled VTX and FVTX 1/2's will then be transported to the PHENIX IR where they will be re-installed, re-surveyed and re-commissioned for service during run 15. The procedure for accomplishing these tasks is attached.				
Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring) None				
Notifications to operations and Operational Limits Requirements: No				
Post Work Testing, Notification or Documentation Required: See Attached Plan				
Job Safety Analysis Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Review Done: <input checked="" type="checkbox"/> in series <input type="checkbox"/> team	
Reviewed by: * Primary Reviewer signature (not required for Worker Planned Work) means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESSH have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.				
Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other				
Required Walkdown Completed				
*Primary Reviewer				

4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.			
Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:
Workers are encouraged to provide feedback on ESSH concerns or on ideas for improved job work flow. Use feedback form or space below.			

5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)			
Name:	Signature:	Life#:	Date:

6. Worker provides feedback.

Worker Feedback (use attached sheets as necessary) a) WCM/WCC: Are there any changes as a result of worker feedback? <input type="checkbox"/> Yes <input type="checkbox"/> No Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

FVTX & VTX Detectors Handling, Assembly & Installation Procedure**Introduction**

During the 2010 through 2013 shutdowns the PHENIX technical staff assembled and installed 2 new detector subsystems known as the VTX and FVTX. The 2 subsystems share a common mounting and enclosure structure, cooling utilities infrastructure, inerting gas, operational monitoring system and cable management, while powered, operated and readout by independent systems under the auspices of separate detector expert groups within the PHENIX collaboration.

The VTX is comprised of 4 concentric layers of detectors with the inner most 2 layers of the pixel type detector and the outer 2 layers of the strip-pixel variety. The detector signals are read out to circuit boards which amplify and convert the signals to light signals to be transferred to the PHENIX Data Acquisition system via optical fibers. These support electronics are mounted on large circular aluminum disks dubbed "big wheels". The detector and support electronics on the big wheels are cooled to predetermined temperatures for optimum operating conditions using a proprietary thermal transfer fluid, NOVEC 7200. The internal atmosphere of the detector subsystem is kept free of condensation/moisture by flowing gaseous nitrogen.

The FVTX is comprised of 4 disks of detectors longitudinally surrounding the beampipe and spaced north and south of the VTX subsystem. Similar to the VTX, the FVTX is physically divided into 2 semi-cylinders for ease of installation. The detector signals are read out to circuit boards which amplify and convert the signals to light signals to be transferred to the PHENIX Data Acquisition system via optical fibers. These support electronics are mounted on large circular aluminum disks dubbed "big wheels". The detector and support electronics on the big wheels are cooled to predetermined temperatures for optimum operating conditions using a proprietary thermal transfer fluid, NOVEC 7200. The internal atmosphere of the detector subsystem is kept free of condensation/moisture by flowing gaseous nitrogen. The NOVEC 7200 and N₂ distribution systems are shared with the VTX subsystem and having been designed and specified to accommodate both subsystems. No significant changes are proposed to the FVTX components during the 2014 shutdown, but there will be a series of tests and some minor troubleshooting of detector components which have exhibited less than optimal performance during run 14.

During run 11 faults were detected in the VTX pixel subsystem that were partially repaired and corrected during the 2011 & 2012 shutdowns and completed during the 2013 shutdown. In addition, leaks developed in the strip-pixel subsystem during commissioning for run 13 resulting in the removal of some components prior to run 13. During run 13 these components were analyzed and the leaks diagnosed as being due to galvanic corrosion of the aluminum cooling tubes. PHENIX engineering and FVTX experts have re-designed the cooling tubes to prevent recurrence of the problems and new component parts have been ordered and were received early in the 2013 shutdown. The strip pixel layers were completely rebuilt, retested and reinstalled in the VTX in time for run 14. No recurrence of the problem has been noted during run 14, however there have been problems of leakage found in the Teflon return lines resulting in the replacement of Teflon lines with

stainless steel lines. There has been no further degradation (leakage) since then, but as a precaution remaining Teflon lines will be replaced with stainless lines wherever feasible during the 2014 shutdown.

In this document, all facets of the repairs, upgrades, assembly, installation, alignment, and commissioning of the 2 detector subsystems and their support equipment, handling for removal of the VTX and FVTX subsystems, de-integration disassembly and re-integration of the FVTX into the VTX are discussed, related documents are referenced and the procedures to be followed are detailed.

(Note: The FVTX & VTX Integration Plan illustrates the work covered in this procedure and is attached hereto. In addition the VTX installation work permits from the 2010, 2011, 2012 and 2013 shutdowns included the VTX cooling plan, VTX survey plan, VTX assembly plan and VTX assembly procedure which are essentially unchanged for the 2014 VTX & FVTX re-installation except as noted herein. Copies of that work permit are available for reference purposes.)

End of Run Status Tests

Immediately after the end of run 14, a series of VTX and FVTX status tests shall be conducted under both normal operating conditions (i.e. cold) and again with the NOVEC warmed to near room temperature. These tests will be used to determine where actual damage requiring removal and replacement has occurred and where re-calibration or minor troubleshooting and repair can be performed in-situ to restore nominal operating capabilities.

Removal of VTX/FVTX from CM Region

I. Removing Cabling and piping services (East & West Detectors)

- a. Carefully label all Bias, LV, signal and monitoring cables with the VTX & FVTX numbering systems currently in use to minimize confusion when restoring these services
- b. Similarly carefully label all piping connections for cooling and environmental control.
- c. Disconnect each cable, one at a time, coil the cables neatly and use cable ties to secure the cables in an area they will be safe until need again during re-installation of the VTX/FVTX.
- d. Turn off coolant flow and drain all coolant from the VTX & FVTX detectors and bigwheel electronics.
- e. Disconnect all piping, plug the VTX & FVTX fluid connections and cap the piping.

- f. Coil all piping and secure it where it will remain safe until need again during re-installation of the VTX/FVTX.
- g. Install the east and west support rail installation extensions. Install the soft beampipe shield and hard beampipe protectors around the central beampipe.

II. East Detector Section Removal

- a. Separate the east VTX/FVTX detector half from the west half.
- b. Slide the east half detector away from the beampipe.
- c. Mount the VTX/FVTX installation fixture on the east VTX/FVTX detector half
- d. Rig the east VTX/FVT detector half installation fixture to the IR crane lift it off the rails and set it on the 12 ton cart to transport the assembly to the PHENIX AH, taking care not to jostle or otherwise disturb, distort, twist or shock the assembly.
- e. Rig the east VTX/FVTX detector half from the cart to the AH floor
- f. Transport the east half on a smooth riding vehicle with vibration isolation to prevent motion damage to the detector, to the assigned Chemistry lab for maintenance and upgrade.

III. West Detector Section Removal (Note: this section may not be implemented if the End of Run Status tests indicate that removal of the west detector half is not necessary. If the West 1/2 detector is not dismounted then all steps specifically relating to the West 1/2 in all sections below can be skipped)

- a. Retract west VTX/FVTX to its "open" parked position
- b. Attach the transport fixture to the west detector half.
- c. Rig the transport fixture to the IR crane and lower the west half to the horizontal position.
- d. Disconnect the rigging from the crane.
- e. Slide the west VTX/FVTX detector half carefully under the Beampipe taking care to avoid any potential snags or pinch points, and taking exceptional care to avoid contact with the beampipe and/or the beampipe protectors (soft and hard).
- f. Attach rigging to the transport fixture.

- g. Lift the west detector half from the rails and carefully place the west half on the 12 ton cart to transport the assembly to the PHENIX AH, taking care not to jostle or otherwise disturb, distort, twist or shock the assembly.
- h. Rig the west VTX/FVTX detector half from the cart to the AH floor
- i. Transport the west half on a smooth riding vehicle with vibration isolation to prevent motion damage to the detector, to the assigned PHYSICS lab for maintenance and upgrade.

VTX & FVTX Maintenance, Repair and Upgrade

The VTX assembly experienced some problems during its maiden run. These problems were diagnosed and repair procedures, hardware upgrades and assembly techniques have been established during the 2011 shutdown but not completed at that time. After receipt of the VTX/FVTX halves at the assigned PHYSICS lab, the 1/2's will be dis-assembled, the FVTX sections will be separately serviced in the same PHYSICS lab for maintenance, repairs and upgrading by FVTX group experts, while the VTX 1/2's will be dis-assembled in the same lab to the barrel level for appropriate maintenance, repair and upgrade.

During this procedure at appropriate levels of partial assembly, PHENIX technicians and BNL surveyors shall make a series of inspection measurements. These measurements are performed to assure positioning and alignment of internal components to the drawing requirements for accuracy and tolerance and to establish reference points to relate inner layers of the detector to outer layers and ultimately to the external surfaces of the completed detector. Since each layer tends to obscure the layer before it during assembly, it is critical that these reference points are established at appropriate junctures during the assembly. These inspection survey techniques were established during last 4 year's shutdowns and will be repeated for the VTX and FVTX assemblies this year.

FVTX Integration into VTX

Integration of the FVTX subsystem into the common support structure and gas enclosure with the VTX subsystem shall take place in the VTX lab in the BNL PHYSICS Department. Details of the assembly are described in the FVTX/VTX Plan, established during the 2011 shutdown. This plan is attached to this work permit.

FVTX & VTX Combined Installation Procedure

I. West Detector Subsystems Section

- a. After completion of assembly, pre-survey and alignment of the FVTX/VTX detector halve(s), the west half shall be mounted on the FVTX/VTX Installation fixture with the OD of the detector facing down and transported to the PHENIX Assembly Hall ("AH"), taking care not to jostle or otherwise disturb, distort, twist or shock the assembly.
- b. Install the east and west support rail installation extensions. Install the soft beampipe shield and hard beampipe protectors around the central beampipe.

- c. Rig the west FVTX/VTX detector half onto the PHENIX 12 ton cart in the AH then roll the cart into the IR.
- d. Rig the west FVTX/VTX detector half from the 12 ton cart to the east extension rail with the top of the detector facing west and the OD of the detector half facing down.
- e. Slide the west FVTX/VTX detector half carefully under the Beampipe taking care to avoid any potential snags or pinch points, and taking exceptional care to avoid contact with the beampipe and/or the beampipe protectors (soft and hard)
- f. After the detector is fully translated west under and clear of the beampipe, install stops to prevent the west half from contacting the beampipe.
- g. Remove the hard and soft beampipe protectors.
- h. Attach the IR crane to the lifting point on the FVTX/VTX installation fixture and carefully rotate the beampipe into its upright and open position.
- i. Check alignment and make sure the west half has been restored to its aligned position relative to the rails.
- j. Align/Survey the west FVTX/VTX detector half relative to the beampipe and PHENIX IR nominal IP, make appropriate corrections to the west half detector stops.
- k. Retract west FVTX/VTX to its "open" parked position.

II. East Detector section

- a. Mount the east FVTX/VTX detector half on the FVTX/VTX installation fixture and transport the assembly to the PHENIX AH, taking care not to jostle or otherwise disturb, distort, twist or shock the assembly.
- b. Rig the east FVTX/VTX detector half onto the PHENIX 12 ton cart in the AH then roll the cart into the IR.
- c. Rig the east FVTX/VTX detector half from the 12 ton cart to the east extension rail in the upright position. Slide the east half detector near the beampipe and make precision adjustments as necessary to get it near its final position.
- d. Slide the east half detector into its aligned position against the rail stops.

- e. Mate the east FVTX/VTX detector half to the west half.

Final Survey and Alignment

After the FVTX/VTX east and west detector halves have been joined survey the entire detector by the external reference points established during pre-survey and record all info in the PHENIX survey data base.

Cooling, Gas Utilities and Electrical/Electronic Support

The FVTX/VTX detector requires cooling of its internal detector subsystems electronics to approximately 0°C and its routing electronics ("Big Wheel" electronics) to approximately room temperature. FVTX/VTX group experts have chosen Novec 7200 as the cooling medium for both internal and routing electronics for both detectors. The chiller system was installed and operated for the VTX subsystem in 2010 and the additional circuits, manifolding and flow control for the FVTX were installed in 2011. Changes to the cooling system were made during the 2012 shutdown to optimize flow and pressure management (i.e. reducing bends, line lengths and flow restrictions) while making no changes to the cooling scheme. There were no major changes implemented for the cooling system during the 2013 shutdown.

Gas utilities for this project consist only of gaseous N₂, to be supplied by the PHENIX N₂ gas system. Installation of the N₂ flow control, piping, and all tasks in support of the N₂ flow control and piping were installed during the 2010 VTX installation and are fully described in the work permit for that effort.

Electrical/electronic support for the VTX and FVTX are already in place and have been fully operational since Run 12. No significant changes are planned for the electrical/electronic support systems during the 2013 shutdown, but changes to the return lines replacing Teflon with stainless steel were implemented during run 14.

Testing and Commissioning

Testing and commissioning of the installed FVTX/VTX detector subsystem shall commence immediately after mechanical installation of components is complete. The testing and commissioning efforts shall be performed by PHENIX technicians, engineers and FVTX/VTX subsystem experts. These operational tests are intended to validate the installation, operation and control of the 2 subsystems to verify the restoration of the

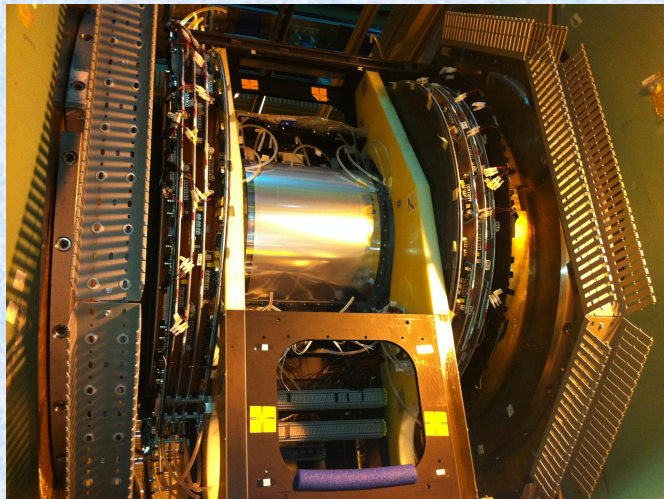
subsystems to their full operational condition.

Installation Closeout

When all work described in this work permit has been completed, the PHENIX work coordinator for this set of tasks shall collect feedback from all parties (PHENIX engineers and technicians and FVTX/VTX experts). This feedback shall include critical review of any problems encountered during installation, solutions to such problems, changes to work procedures described herein during the conduct of this work, suggestions for improvements in equipment procedures and techniques and any other information deemed useful and/or relevant by the PHENIX work control coordinator. Such information shall be appropriately disseminated to the various affected/interested parties and a copy of this information shall be attached to this work permit when it is closed out.

f.

VTX/FVTX Removal, Maintenance Upgrade and Re-installation



6/26/2014

 **PHENIX** 2014 Shutdown

Slide # 1

VTX & FVTX Summary of Tasks

VTX/FVTX Disassembly - After Start of shutdown tasks are completed (EC out to AH), coolant and N₂ lines, LV, signal and HV cables and fibers will be carefully removed and coolant drained. East and west detector halves will then be de-mounted and transported to Chemistry bldg for maintenance and overhaul.

At PHYSICS lab - VTX, bigwheels and FVTX will be disassembled and all 4 FVTX stations will be transported to the FVTX PHYSICS Lab.

At PHYSICS lab -FVTX stations will be tested, faults will be isolated, repaired and re-tested. Concurrently VTX will be disassembled into individual barrels and bigwheels, new /reworked pixel staves will be installed, improved strip-pixel staves will be fabricated assembled and integrated with active components harvested from staves to be replaced, tested and reinstalled in their respective barrels. The VTX will then be re-assembled tested and re-surveyed as required.

FVTX Integrated into VTX. VTX/FVTX assembly surveyed

VTX&FVTX assembly transported to PHENIX and installed on rails.

Coolant and N₂ lines, LV, signal and HV cables and fibers will be carefully reattached.

Full detector re-surveyed in IR

During Shutdown:

VTX Shutdown Activities

Post-Run Studies in the IR:

- VTX Pixels: None
- VTX StriPixels: Bias studies. Requires bias current measurements varying the N2 flow and warming the detector up. Warm up studies will be last after all "cold" work by (F)VTX groups is complete in order to avoid thermal cycling of the detector. Expect the work to take of order 1 day (half day cold/half day warm).
- FVTX: FVTX group has a number of problems observed only in IR. Group needs to prioritize the list based on what needs to be done "cold" and what can be done once the detector is "warm" and estimate the amount of time for the work.

Physics Lab Work:

- General: Mike L. has requested a couple of days once the detector is in the lab to look at the detector in order to see what can be done to improve the flow of N2 and better seal against condensation.
- VTX Pixel: Investigate one bad ladder on east detector (B1-L11). Will concentrate on one end first. Will require access to the SPIRO Board. This requires removal of FVTX 1/2 cage and Bigwheel, and a couple of Pixel Bigwheels. Depending on what the problem is may require access to SPIRO board on opposite end.
- VTX StriPixels: Investigate one bad ladder on east detector (B3-L16). Requires access to LDTB. This requires removal of south FVTX 1/2 cage and south Pixel Bigwheels. Depending on outcome of IR bias studies
- FVTX: Number of ROC issues. Can be done with 1/2 cages installed or removed

IR Infrastructure after East detector is removed

- Chillers: general repair and maintenance of the 3 chillers. Requires tech time and support for BNL HVAC group.
- Cooling lines: Replace Teflon tubing in the vicinity of the detector with stainless steel tubing. Look at any rerouting of stainless steel lines that were added during the run.
- Interlocks: Review flow interlock hardware and update/modify as needed. Provide additional interlocks and monitoring for 4th chiller if added

6/26/2014

 **PHENIX** 2014 Shutdown

Slide # 3
3

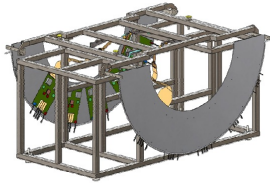
FVTX Shutdown Activities

During Shutdown:

- July 7-9:
 - Cold Tests- Chillers are 10C and 0C
- July 10-13:
 - Start chiller warmup
 - VTXS bias studies
 - Additional IR studies as needed
- July 14:
 - Prep East detector for move to Physics
 - Place West Detector in “safe” condition for summer
- August 4:
 - Disassemble East Detector
 - Subsystem testing
- October 1:
 - All subsystem work complete
 - Prep East Detector for reassembly
- October 15
 - Reassembly complete
 - Final testing of assembled detector
 - Survey as required.

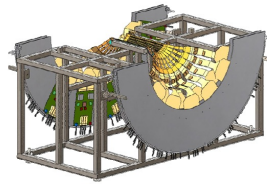
Barrel 1 Assembly (Stave Installation)

- Pixel Stave are installed in Barrel 1 Mount
- Extension Cables are attached to the Spiro Cards



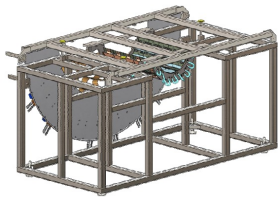
Barrel 2 Assembly (Cooling Tube Installation)

- After all Staves are installed, Cooling Tubes are connected
- The Big Wheels are moved to their final positions



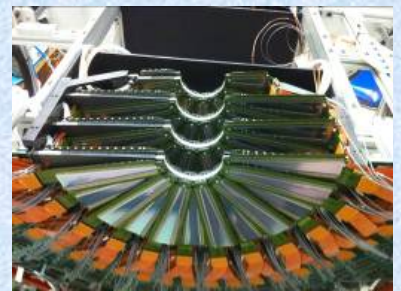
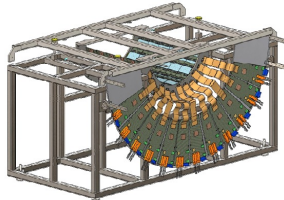
Barrel 3 Assembly (Transport Frame)

- Transport Frame is attached to the Barrel 3 Mounts
 - The Transport Frame has adjustment screws so that it can be carefully matched to the Barrel Mounts



Barrel 4 Assembly (Transport Frame)

- Transport Frame is attached to the Barrel 4 Mounts
 - The Transport Frame has adjustment screws so that it can be carefully matched to the Barrel Mounts

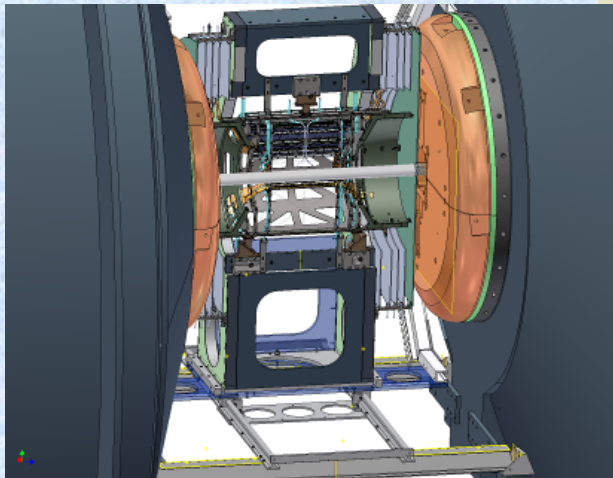
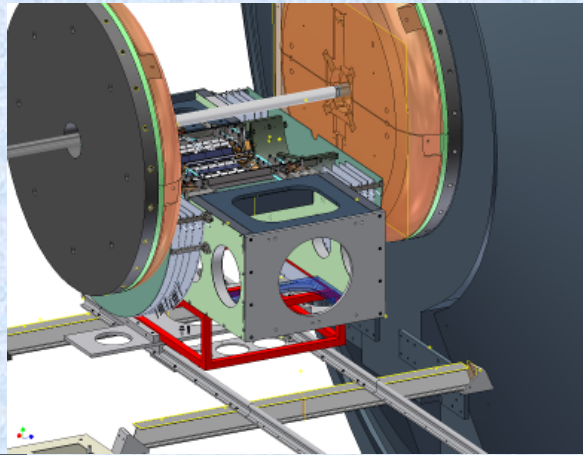


VTX and FVTX will be disassembled to their component layers and diagnosed for faults, repairing or replacing faulty components. The VTX pixel and strip-pixel barrel layers will be serviced at PHYSICS while the FVTX wedge layers will be concurrently serviced and returned to the Chemistry lab for re-integration with VTX and survey.



VTX/FVTX Installation Plan

(Same as last 3
years)



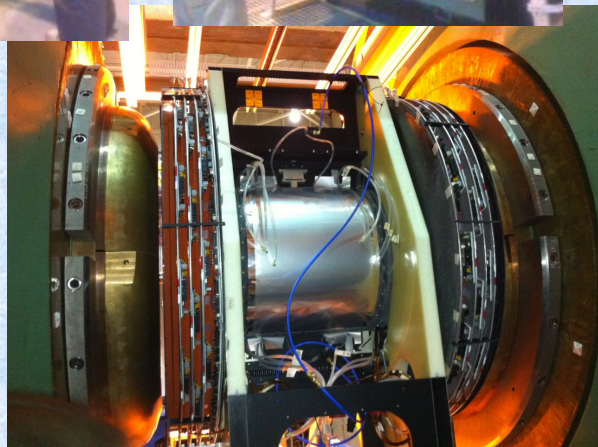
(Note: West $\frac{1}{2}$ is likely to stay in IR if determined that problems are minimal and maintenance/repair/upgrade needs can be performed in-situ.) If West is removed then West $\frac{1}{2}$ of VTX lifted by crane with slings to extended rail and slid under BP to the west rail extension, then rotated with slings and crane to upright position and placed on west side in approximate final position. East side then lifted with slings and place on east extended rails. Final alignment and alignment stops added with survey group.

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PH^{ENIX} 2014 Shutdown

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VTX Installation 2010,
2011 & 2012. 2014 Removal
and re-installation will be
essentially the same.



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PH^{ENIX} 2014 Shutdown

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2014 Shutdown Schedule

Set up Physics lab for FVTX/VTX east	6/15/2014
Start of Shutdown Tasks (purge flammable gas, disassemble and stow shield wall, remove collars, move EC to AH, Move MMS south, etc.)	7/14 - 7/25/2014
In-Situ Cold & Warm tests of VTX and FVTX	7/7-7/10
Remove FVTX/VTX East to PHYSICS, repair and reinstall	7/14 - 9/15/2014
Cooling system maintenance repair and upgrade	7/14 - 9/15/2014

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2013 Shutdown Schedule (Continued)

MuTR Troubleshooting, maintenance and repairs	7/22-9/27/2013
Summer Sunday (8/11) Prep and teardown	7/29-8/6/2013
Summer Sunday (RHIC)	8/4/2013
DC East Window Upgrade and Related Repairs	8/19-9/27/2013
sPHENIX HCal Prototype Assembly/test	8/19-10/15/2013
Labor Day Holiday	9/2/2013
Re-assemble VTX/FVTX halves	8/19-10/14/2013
Test, survey (at Chemistry and IR) and re-install VTX/FVTX	10/14-10/21/2013
Install & Survey VTX/FVTX in 1008 IR	10/21-11/18/2013
VTX Commissioning	11/18-12/9/2013
Other detector maintenance as required	As required
Infrastructure maintenance as required	As required
TBD prototype tasks	As required
Pre-run commissioning and prep for run 14	11/1-12/31/2012
Veterans Day, Lab Holiday	11/11/2013
Prep for EC roll in	11/1-11/9/2013
Roll in EC	11/10-11/12/2013
Prep IR for run	11/1-11/30/2013
Thanksgiving Holidays	11/28-29/2013
Pink/Blue/White sheets	12/14-12/31/2013
Christmas Holiday	12/24-25/2013
New Year's Day Holiday	1/1/2014
Start run 14	1/2/2014

Where To Find PHENIX Engineering Info

Shutdown Schedule is updated weekly fpor the weekly PHENIX Planning meeting. Current schedule is always available by following the weekly planning links at the website below.

http://www.phenix.bnl.gov/WWW/INTEGRATION/ME&Integration/DRL_SSint-page.htm

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